

Study Area: PG&E Bulk

Thermal Overloads



ID	Overloaded Facility	Worst Contingency	Category	Category Description	Loading (%)								Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	N/A	
PGE Blk-T-1	Chico Jct-Anita 60 kV	normal conditions	P0	normal	135.7%	137.0%	113.6%	141.3%	<95%	<95%	<95%	N/A	radial line, section of Glenn-Anita line, mitigation in area studies
PGE Blk-T-2	Glenn-Capay Jct - Headgate 60 kV	normal conditions	P0	normal	121.0%	121.7%	100.6%	124.7%	<95%	<95%	<95%	N/A	radial line, section of Glenn-Anita line, mitigation in area studies
PGE Blk-T-3	Taft-TX_BV_Hills 70 kV	normal conditions	P0	normal	116.7%	116.7%	110.8%	117.5%	<95%	<95%	<95%	N/A	radial line, section of Taft-Elk Hills 70 kV, mitigation in area studies
PGE Blk-T-4	Highlands Jct-Low Lake Jct 115 kV	normal conditions	P0	normal	109.6%	104.1%	<95%	99.6%	<95%	<95%	<95%	N/A	section of Eagle Rk-Red Bud 115 kV line, wrong rating
PGE Blk-T-5	Vaca Dix- Winters-Plain Fld 60 kV	normal conditions	P0	normal	107.7%	110.0%	<95%	<95%	<95%	<95%	<95%	N/A	radial line, low voltage (0.886), moved to 115 kV in 2025, mitigation in area studies
PGE Blk-T-6	Chowchilla-Chowchilla gen Jct 115 kV	normal conditions	P0	normal	99.1%	101.1%	<95%	102.5%	100.1%	<95%	<95%	N/A	reduce output from Chowch co-gen (bus 34301)
PGE Blk-T-7	E. Nicolaus-Plumas 60 kV	normal conditions	P0	normal	<95%	100.5%	108.6%	129.4%	<95%	<95%	<95%	N/A	radial line, mitigation in area studies
PGE Blk-T-8	Merced-Mc Farland 70 kV	normal conditions	P0	normal	<95%	100.1%	<95%	<95%	<95%	<95%	<95%	N/A	radial line, mitigation in area studies
PGE Blk-T-9	Midway-SM1T013041 (Semitropic) 115 kV	normal conditions	P0	normal	<95%	<95%	122.4%	116.7%	<95%	<95%	<95%	N/A	change Midway-Semitropic 115 kV line configuration
PGE Blk-T-10	Wyandette-Wyandette Jct (Palermo) 115 kV	normal conditions	P0	normal	<95%	<95%	<95%	101.2%	<95%	<95%	<95%	N/A	radial line, mitigation in area studies
PGE Blk-T-11	Avenal T - Kettleman T 70 kV	normal conditions	P0	normal	<95%	<95%	<95%	<95%	99.9%	<95%	100.4%	N/A	reduce output from Sun City
PGE Blk-T-13	Delevan-Cortina 230 kV	Olinda-Tracy 500 kV	P1	L-1	<95%	100.8%	<95%	100.7%	<95%	<95%	<95%	N/A	reduce Colusa generation or upgrade/rerate the line
PGE Blk-T-13	Delevan-Cortina 230 kV	Table Mtn-Vaca Dix 500 kV	P1	L-1	<95%	101.0%	<95%	100.5%	<95%	<95%	<95%	N/A	reduce Colusa generation or upgrade/rerate the line
PGE Blk-T-14	Eight Mile - Lodi 230 kV	Table Mtn 500/230 kV x-former	P1	T-1	<95%	<95%	<95%	<95%	98.1%	<95%	<95%	N/A	not a violation, reduce Lodi generation if overload
PGE Blk-T-14	Eight Mile - Lodi 230 kV	Table Mtn 500/230 kV x-former & Diablo # 1 unit	P3	T-1/G-1	<95%	<95%	<95%	<95%	99.7%	<95%	<95%	N/A	not a violation, reduce Lodi generation if overload
PGE Blk-T-15	MOSSLND2 - LASAGUIL 230 kV #2	Moss Landing 500/230 kV x-former	P1	T-1	<95%	<95%	<95%	<95%	<95%	<95%	96.6%	N/A	not a violation

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PGE Blk-T-12	Rnd Mtn –Table Mtn #1 or #2 500 kV	Rnd Mtn –Table Mtn #2 or #1 500 kV	P1	L-1	101.1%	102.1%	<95%	102.8%	<95%	<95%	<95%	N/A	bypass ser caps on the remaining Round Mtn-Table Mtn 500 kV line or Tbl Mtn-Vaca Dix or reduce COI flow according to seasonal nomogram
PGE Blk-T-16	Round Mtn 500/230 kV x-former	Capt Jack-Olinda 500 kV	P1	L-1	<95%	<95%	<95%	<95%	<95%	<95%	98.6%	N/A	not a violation, turning off shunt cap at Malin will reduce flow
PGE Blk-T-13	Delevan-Cortina 230 kV	Vaca Dix 500 kV stuck brk	P4	BRK	<95%	103.1%	<95%	101.5%	<95%	<95%	<95%	N/A	upgrade/rerate the line or reduce Colusa generation, Colusa dispatch is lower in 2017
PGE Blk-T-15	MOSSLND2-LASAGUIL 230.0 #2	Los Banos stuck Brk 500 kV	P4	BRK	<95%	<95%	<95%	<95%	<95%	<95%	98.1%	N/A	not a violation
PGE Blk-T-15	MOSSLND2 - LASAGUIL 230 kV #2	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	189.0%	112.3%	167.2%	117.8%	<95%	166.0%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-15	MOSSLND2 - LASAGUIL 230 kV #2	Moss Landing-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	103.0%	<95%	96.6%	<95%	<95%	115.6%	N/A	Open Mosslanding-Lasaguilass 230 kV line
PGE Blk-T-26	LASAGUILASS - PANOCHE 230 1 & 2	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	108.6%	<95%	99.4%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-27	LONETREE-USWP-JRW 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	100.9%	<95%	<95%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-28	LS ESTEROS - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Metcalf 500 kV	P6	L-1/L-1	<95%	106.0%	<95%	<95%	<95%	<95%	<95%	N/A	dispatch Ls Esteros peakers after 1st contingency
PGE Blk-T-28	LS ESTEROS - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	145.4%	<95%	120.1%	100.4%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.

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PGE Blk-T-29	METCALF 500/230 kV x-former #13	Metcalf 500/230 kV Tranformers #11 and #12	P6	T-1/T-1	<95%	117.0%	<95%	105.8%	<95%	<95%	<95%	N/A	dispatch Ls Esteros peakers after 1st contingency, trip load in San Jose if overload persists
PGE Blk-T-30	N.DUBLIN-CAYETANO 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	102.1%	<95%	<95%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-31	NEWARK 230/115 # 11	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	103.4%	<95%	<95%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-32	NEWARK E - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Metcalf 500 kV	P6	L-1/L-1	<95%	109.1%	<95%	<95%	<95%	<95%	<95%	N/A	dispatch Ls Esteros peakers after 1st contingency
PGE Blk-T-32	NEWARK E - NWK DIST 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	145.7%	96.3%	122.5%	97.9%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-33	NEWARK F - LCKHD J1 115 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	136.4%	103.5%	125.6%	97.9%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-34	NEWARK F -DIXON LD 115 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	109.8%	<95%	96.4%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-21	OLINDA 500 / 230 kV transformer	Malin-Round Mountain #1 and Olinda-Tracy 500 kV	P6	L-1/L-1	<95%	<95%	<95%	<95%	<95%	<95%	107.7%	N/A	use Colusa SPS for off-peak overload
PGE Blk-T-12	ROUND MT -TABLE MT 500 kV #2 (or #1)	Round Mountain-Table Mountain #1 (or # 2) and Olinda-Tracy 500 kV	P6	L-1/L-1	<95%	<95%	97.5%	106.0%	<95%	<95%	<95%	N/A	Reduce flow after first contingency. Bypass series caps on remaining Round Mtn-Table Mtn line if overload
PGE Blk-T-12	ROUND MT -TABLE MT 500 kV #2 (or #1)	Round Mountain-Table Mountain #1 (or # 2) and Capt Jack-Olinda 500 kV	P6	L-1/L-1	<95%	<95%	<95%	101.9%	<95%	<95%	<95%	N/A	Reduce flow after first contingency. Bypass series caps on remaining Round Mtn-Table Mtn line if overload



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					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	N/A	
PGE Blk-T-35	TRACY 500 /230 kV x-former #1	Tesla-Tracy 500 kV Line and Tracy 500/230 kV x-former # 2	P6	L-1/T-1	<95%	108.1%	<95%	105.3%	<95%	<95%	<95%	N/A	open Tracy-Tesla 230 kV lines if overload
PGE Blk-T-36	TRIMBLE-SJB DG 115 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	129.8%	116.9%	136.4%	103.9%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-37	USWP-JRW-CAYETANO 230 kV	Tesla-Metcalf 500 kV & Moss Landing-Los Banos 500 kV	P6	L-1/L-1	<95%	108.2%	97.0%	99.5%	<95%	<95%	<95%	N/A	Dispatch generation in San Jose. Sectionalize San Jose system. Other mitigation measures are being evaluated.
PGE Blk-T-17	Captain Jack-Olinda 500 kV	Malin- Round Mtn #1 and #2 500 kV	P7	L-2	103.2%	104.9%	99.5%	104.5%	<95%	<95%	96.5%	N/A	operate within COI nomogram
PGE Blk-T-17	Captain Jack-Olinda 500 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	P7	L-2	104.1%	106.2%	99.3%	105.6%	<95%	<95%	<95%	N/A	operate within COI nomogram
PGE Blk-T-19	Cottonwd E-Round Mtn 230kV #3	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	101.9%	105.0%	<95%	105.6%	<95%	<95%	<95%	N/A	upgrade the line, or limit COI import within nomogram
PGE Blk-T-20	Cottonwood-Round Mtn # 2 230 kV	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	<95%	95.7%	<95%	96.4%	<95%	<95%	<95%	N/A	upgrade the line, or limit COI import within nomogram
PGE Blk-T-13	Delevan-Cortina 230 kV	Round Mtn-Table Mtn # 1 and # 2 500 kV	P7	L-2	96.5%	110.8%	<95%	109.6%	<95%	<95%	<95%	N/A	upgrade/rerate the line, or modify RAS to trip Colusa generation
PGE Blk-T-13	Delevan-Cortina 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	98.0%	112.5%	<95%	111.1%	<95%	<95%	<95%	N/A	upgrade/rerate the line, or modify RAS to trip Colusa generation
PGE Blk-T-22	Gregg-Ashlan 230 kV	Gregg-Herndon 230 kV # 1 and 2	P7	L-2	152.5%	<95%	<95%	<95%	<95%	<95%	<95%	N/A	Ashlan upgrade project, SPS prior to upgrade
PGE Blk-T-23	Midway-Kern #1 230 kV	Midway-Kern 230 kV # 2 and 3	P7	L-2	125.5%	<95%	<95%	<95%	<95%	<95%	<95%	N/A	trip Bakersfield and Stockdale load prior to upgrade
PGE Blk-T-9	Midway-SM1T0130 115 kV	Midway-Kern PP 230 kV # 2 and 3	P7	L-2	<95%	<95%	123.1%	118.2%	<95%	<95%	<95%	N/A	change Midway-Semitropic 115 kV line configuration in 2025
PGE Blk-T-21	Olinda500/230 kV x-former	Malin-Round Mtn # 1 and # 2 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	109.5%	N/A	use Colusa SPS
PGE Blk-T-24	Rio Oso-Gleaf Tp 115 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	99.2%	<95%	<95%	<95%	<95%	<95%	<95%	N/A	South of Palermo Project. Prior to the project: limit COI import within nomogram
PGE Blk-T-16	Round Mtn 500/230 kV x-former	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	97.3%	N/A	open Round Mtn bank
PGE Blk-T-16	Round Mtn 500/230 kV x-former	Round Mtn-Table Mtn # 1 and # 2 500 kV	P7	L-2	<95%	<95%	<95%	<95%	<95%	<95%	108.6%	N/A	open Round Mtn bank
PGE Blk-T-25	Table Mtn-Rio Oso 230 kV	Tbl Mtn-Tesla and Tbl Mtn-Vaca Dix 500 kV	P7	L-2	108.1%	113.4%	<95%	114.2%	<95%	<95%	<95%	N/A	Upgrade terminal equipment on this line.

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PGE Blk-T-18	Captain Jack-Ponderosa B 500 kV	PDCI bi-pole	P7	DC bipole	102.6%	100.2%	<95%	101.0%	N/A	<95%	N/A	N/A	don't insert Fort Rock series caps or operate within COI nomogram, contact BPA to discuss
PGE Blk-T-23	Ponderosa-Summer Lake 500 kV	PDCI bi-pole	P7	DC bipole	111.3%	<95%	<95%	<95%	N/A	<95%	N/A	N/A	contact BPA to discuss

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Voltage Deviations



ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %								Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	N/A	
PGE Blk-VD-1	HOLLISTR 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.4%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-2	NTVD SW2 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-3	NTVD SW1 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-4	Green Vly # 1 and 2 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-5	Camp Evers 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-6	Rob Roy 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.3%	<5%	5.4%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-7	Paul Sweet 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-8	PRUNEDLE 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	5.9%	<5%	5.1%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-9	SOLEDAD 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.6%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-10	SALINAS 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-11	Moss Landing E and D 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	5.7%	<5%	<5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-12	CSTRVLE 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	5.7%	<5%	<5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-13	Dolan Rd 115 kV	Moss Landing 500/230 kV x-former	P1	T-1	<5%	5.7%	<5%	<5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-14	DEL MNTE 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.1%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-15	HOLST D 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.4%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-16	SNBENITO 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-17	WTSNVLE 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-18	GRANT RK 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-19	BRIGTANO 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-20	LGNTS J1 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-21	GABILAN 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-22	SALINAS2 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-23	SALINAS1 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-24	BORONDA 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-25	FORT ORD 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps

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PGE Blk-VD-26	DEL MNTE 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-27	MONTEREY 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-28	NAVY SCHL 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-29	VIEJO 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-30	HATTON 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-31	NAVY LAB 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-32	RSVTN RD 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-33	LAURELES 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.6%	5.0%	5.7%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-34	OTTER 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.7%	5.1%	5.8%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-35	FRSHXPRS 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.3%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-36	BNA VSTA 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.3%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-37	FIRESTNE 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-38	SPENCE 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.4%	<5%	5.5%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-39	SNBRN JT 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-40	IND.ACRE 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.2%	<5%	5.3%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-41	9 ST JCT 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.7%	5.1%	5.8%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-42	CMPHR J2 and J1 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.6%	5.0%	5.6%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-43	GONZALES 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.7%	5.1%	5.8%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-44	CAMPORA 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.5%	5.0%	5.6%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-45	SOLEDAD 60.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.5%	<5%	5.6%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-46	SLD ENRG 12.5	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.5%	<5%	5.6%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-47	CRZY_HRS 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.0%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-48	NATIVDAD 115.0	Moss Landing 500/230 kV x-former	P1	T-1	<5%	6.1%	<5%	5.2%	<5%	<5%	<5%	N/A	adjust svds and transformer taps
PGE Blk-VD-49	buses in NW 115 kV and below	PDCI mono-pole outage	P1	PDCI	<5%	<5%	<5%	up to 5.2%	N/A		N/A	N/A	adjust svds and transformer taps

Study Area: **PG&E Bulk**

Voltage Deviations



ID	Substation	Worst Contingency	Category	Category Description	Post Cont. Voltage Deviation %								Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	N/A	
PGE Blk-VD-50	Sylmar 230 kV (SCE and LA)	PDCI mono-pole outage	P1	PDCI	<5%	<5%	<5%	<5%	N/A	up to -5.7% (deviation up)	N/A	N/A	turn off shunt caps at Sylmar

Study Area: **PG&E Bulk**

High/Low Voltage



ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	
PGE Blk-V-1	500 kV in NW, Round Mt, Table Mt	normal conditions and all contingencies	P0	normal	<550 kV	<550 kV	<550 kV	<550 kV	up to 553 kV	up to 559 kV	up to 554 kV	consider installing additional reactors
PGE Blk-V-2	BIG EDDY 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	<550 kV	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-3	HANFORD 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-4	JOHN DAY 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-5	LANE 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	554	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-6	MARION 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	551	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-7	SLATT 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-8	TROUTDAL 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	551	<550 kV	<550 kV	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-9	WAUTOMA 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	551	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-10	CELILO1 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	<550 kV	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-11	CELILO2 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	553	<550 kV	<550 kV	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-12	ROCK CK 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	551	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-13	KNIGHT 500.0	Malin-Round Mtn 500 kV # 1 and 2	P7	L-2	551	<550 kV	<550 kV	550	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-14	ALVEY 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-15	ALVEY 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	557	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-16	ASHE 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	540	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-17	ASHE 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	551	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-18	BIG EDDY 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	552	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-19	BIG EDDY 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	552	552	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-20	BUCKLEY 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	555	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-21	BUCKLEY 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	555	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-22	GRIZZLY 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	555	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-23	GRIZZLY 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	554	<550 kV	555	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-24	HANFORD 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-25	HANFORD 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	554	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage

Study Area: **PG&E Bulk**

High/Low Voltage



ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	
PGE Blk-V-26	JOHN DAY 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	556	<550 kV	553	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-27	JOHN DAY 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	557	<550 kV	553	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-28	LANE 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	558	<550 kV	559	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-29	LANE 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	560	<550 kV	559	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-30	MALIN 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	553	<550 kV	551	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-31	MALIN 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	557	552	551	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-32	MARION 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	557	<550 kV	<550 kV	<550 kV	<550 kV	activate SVD to absorbs VARs
PGE Blk-V-33	MARION 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	557	<550 kV	558	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-34	OSTRNDER 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	557	552	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-35	OSTRNDER 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	553	<550 kV	557	553	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-36	PEARL 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	<550 kV	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-37	PEARL 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	<550 kV	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-38	PONDROSB 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	554	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-39	PONDROSB 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	558	553	555	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-40	PONDROSA 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	550	557	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-41	PONDROSA 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	555	554	558	552	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-42	SANTIAM 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	554	<550 kV	557	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-43	SANTIAM 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	557	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-44	SLATT 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	556	<550 kV	551	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-45	SLATT 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	557	<550 kV	551	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-46	SUMMER L 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	556	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-47	SUMMER L 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	555	553	556	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-48	TROUTDAL 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	554	<550 kV	553	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-49	TROUTDAL 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	555	<550 kV	554	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-50	VANTAGE 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	550	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage

Study Area: **PG&E Bulk**

High/Low Voltage



ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	
PGE Blk-V-51	VANTAGE 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	551	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-52	WAUTOMA 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-53	WAUTOMA 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-54	CELILO1 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	551	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-55	CELILO1 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	552	553	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-56	CELILO2 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	551	551	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-57	CELILO2 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	552	553	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-580	ROCK CK 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-59	ROCK CK 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	<550 kV	553	550	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-60	KNIGHT 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	554	<550 kV	553	550	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-61	KNIGHT 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	555	<550 kV	553	552	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-62	BOARD F 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-63	BOARD F 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-40	COYOTE 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-65	COYOTE 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-66	LONGHORN 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	551	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-67	LONGHORN 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-68	ROUND BU 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	<550 kV	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-69	ROUND BU 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	552	<550 kV	552	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-70	CAPTJACK 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	550	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-71	CAPTJACK 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	556	553	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-72	DIXONVLE 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	557	<550 kV	550	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-73	DIXONVLE 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	560	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-40	MERIDINP 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	557	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-75	MERIDINP 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	560	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage

Study Area: **PG&E Bulk**

High/Low Voltage



ID	Substation	Worst Contingency	Category	Category Description	Voltage (PU)							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Spring Off-Peak	
PGE Blk-V-76	KFALLS 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	555	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V70	KFALLS 500.0	Table Mtn-Tesla and Tesla-Vaca Dix 500 kV	P7	L-2	559	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off shunt capacitors at high voltage
PGE Blk-V-78	TABLE MT 500.0	Table Mtn-Tesla and Table Mtn-Vaca Dix 500 kV	P7	L-2	552	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	<550 kV	turn off 227 MVA _r of shunt capacitors
PGE Blk-V-79	WHEELER 230	Midway-Vincent # 1 and # 2 500kV w/RAS	P7	L-2	206	>207 kV	>207 kV	>207 kV	>207 kV	>207 kV	>207 kV	install shunt capacitors (approved project)
PGE Blk-V-80	500 kV in NW	Diablo # 1 and #2 units	D	G-2	<550 kV	<550 kV	<550 kV	<550 kV	up to 578 kV	up to 571 kV	up to 586 kV	don't turn on FACRI
PGE Blk-V-81	500 kV in NW	Palo Verde # 1 and #2 units	D	G-2	<550 kV	<550 kV	<550 kV	<550 kV	up to 569 kV	up to 565 kV	up to 579 kV	don't turn on FACRI

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
PGE Blk-TS-1	wind generators at High Winds # 3 (bus 32171)	3 Ph fault Contra Costa-La Positas 230 KV	P1	L-1	tripped for undervoltage (10.5 MW)	tripped for undervoltage (10.5 MW)	tripped for undervoltage (12.5 MW)	tripped for undervoltage (10.5 MW)	tripped for undervoltage (38 MW)	tripped for undervoltage (6.4 MW)	tripped for undervoltage (38 MW)	these are old induction generator units that don't have LVRT, they may trip with faults close to these units
		3 Ph fault Tesla-Newark 230 KV	P1	L-1	none	none	none	none	none	tripped for undervoltage	tripped for undervoltage	
		3 Ph fault Newark-Ravenswood 230 kV	P1	L-1	none	none	none	none	none	tripped for undervoltage	none	
		3Ph fault C.-Costa-Brentwood and C.Costa-Delta 230 kV	P7	L-2	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	
		3 Ph fault Contra Costa-La Positas and C.Costa-Lone Tree 230 KV	P7	L-2	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	
		Tesla 500 kV stuck breaker	P4	BRK	none	none	none	none	tripped for undervoltage	none	tripped for undervoltage	
PGE Blk-TS-2	wind generators at Shilo # 2 (bus 32177)	3Ph fault Contra-Costa-Brentwood and Contra Costa-Delta 230 kV	P7	L-2	tripped for undervoltage (46 MW)	tripped for undervoltage (46 MW)	tripped for undervoltage (49.5 MW)	tripped for undervoltage (46 MW)	tripped for undervoltage (150 MW)	tripped for undervoltage (42.6 MW)	tripped for undervoltage (150 MW)	
		Tesla 500 kV stuck breaker	P4	BRK	none	none	none	none	none	none	tripped for undervoltage	
		3 Ph fault C. Costa-La Positas 230 KV	P1	L-1	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	
		3 Ph fault Tesla-Newark 230 KV	P1	L-1	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	
		3 Ph fault Newark 230 KV, Newark-Ravenswood	P1	L-1	none	none	none	none	none	tripped for undervoltage	tripped for undervoltage	
		3 Ph fault Contra Costa-La Positas and C.Costa-Lone Tree 230 KV	P7	L-2	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	tripped for undervoltage	
		KV	P1	L-1	none	vlt dip 27%		vlt dip 38%				
		3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	vlt dip 32%	vlt dip 27%		vlt dip 61%, freq oscill.				
		3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for out-of-step	vlt dip 43%		vlt dip 61%, freq oscill.				
		3Ph fault on Gates 500 kV, Gates-Diablo 500 kV	P1	L-1	vlt dip 61%, freq oscill.	vlt dip 37%		vlt dip 62%, freq oscill.				
		3Ph fault on Gates 500 kV, Gates-Midway 500 kV	P1	L-1	vlt dip 61%, freq oscill.	vlt dip 38%		vlt dip 61%, freq oscill.				
		3Ph fault on Midway 500 kV, Gates-Midway 500 kV	P1	L-1	vlt dip 41%, freq oscill.	vlt dip 62%, freq oscill.		vlt dip 63%, freq oscill.				
		3Ph fault on Midway 500 kV,Midway-Diablo 500 kV	P1	L-1	vlt dip 36.5%	vlt dip 62%		none				
		3ph fault on Los Banos, Los Banos-Gates # 1 or # 3 500 kV	P1	L-1	vlt dip 56-60%, freq oscill.	vlt dip 34%		vlt dip 40%				
		3ph fault on Los Banos, Los Banos-Midway 500 kV	P1	L-1	vlt dip 53%, freq oscill.	vlt dip 30%		vlt dip 35%				
		3ph fault on Midway, Los Banos-Midway 500 kV	P1	L-1	vlt dip 34%	vlt dip 62% , freq oscill.		vlt dip <25%, 20% for 22 Cyc				
		3ph fault on Midway, Midway-Vincent # 1 or 2 500 kV	P1	L-1	vlt dip 38%	vlt dip 62% , freq oscill.		none				

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
		3ph fault on Midway, Midway-Vincent # 3 500 kV	P1	L-1	vlt dip 35%	vlt dip 62% , freq oscill.	none, lower output than in peak cases	none	off in the case	off in the case	off in the case	
		3ph fault on Mosslanding, Mosslanding-Los Banos 500 kV	P1	L-1	vlt dip 59%, freq oscill.	vlt dip 35%		vlt dip 41%				
		3ph faulf on Round Mtn, Round Mtn-Table Mtn # 1 500 kV	P1	L-1	none	vlt dip 39%		vlt dip 66%, freq oscill				
		3ph faulf on Round Mtn, Round Mtn-Table Mtn # 2 500 kV	P1	L-1	none	vlt dip 62% , freq oscill.		none				
		3ph faulf on Table Mtn, Table MTn-Tesla 500 kV	P1	L-1	none	vlt dip 40%		tripped for out of step				
		3ph faulf on Table Mtn, Table MTn-Vaca Dix 500 kV	P1	L-1	none	vlt dip 41%		vlt dip 67%, freq oscill.				
		3ph faulf on Vaca Dix, Vaca Dix-Tesla 500 kV	P1	L-1	none	vlt dip 61% , freq oscill.		tripped for out of step				
		3ph faulf on Tesla, Tesla-Metcalf 500 kV (with DEC off)	P1	G-1/L-1	none	vlt dip 36%-(44%)		vlt dip 61% (63%)				
		3ph faulf on Tesla, Tesla-Tracy 500 kV	P1	L-1	none	tripped for out-of-step		vlt dip 62%, freq oscill.				
		3ph fault on Tesla 500 kV, Tesla -Los Banos 500 kV	P1	L-1	none	vlt dip 32%		vlt dip 62%				
		3ph fault on Tracy 500 kV, Tracy-Los Banos 500 kV	P1	L-1	none	vlt dip 44% out of step		vlt dip 63%, freq oscill.				
		3ph on Newark 230 kV, Newark-Ravenswood 230 kV	P1	L-1	vlt dip 61%, freq oscill.	vlt dip 27%		vlt dip 30%				
		3ph on Tesla 230 kV,Tesla- Newark 230 kV	P1	L-1	vlt dip42%	vlt dip 27%		vlt dip 36%				
		3Ph fault onTable Mtn 500 kV, Table Mtn 500/230 kV x-former (tripped)	P1	T-1	none	vlt dip 40%		tripped for out-of-step				
		3Ph fault on Los Banos 500 kV, Los Banos 500/230 kV x-former	P1	T-1	vlt dip 55%, freq oscill.	vlt dip 39%		vlt dip 46%				
		3Ph fault on Metcalf 500 kV, Metcalf 500/230 kV x-former	P1	T-1	none	vlt dip 62% , freq oscill.		vlt dip <25%, >20% 22 cyc				
		3Ph fault on Midway 500 kV, Midway 500/230 kV # 12 x-former	P1	T-1	vlt dip 33%	vlt dip 62%		tripped for out-of-step				
		3Ph fault on Tesla 500 kV, Tesla 500/230 kV x-former	P1	T-1	none	vlt dip 31% out of step		vlt dip 62%				
		3Ph fault on Tracy 500 kV, Tracy 500/230 kV x-former	P1	T-1	none	vlt dip 41%		vlt dip 62% , freq oscill.				
		3Ph fault on Gates 500 kV, Gates 500/230 kV x-former	P1	T-1	vlt dip 53%	vlt dip 33%		vlt dip 47%				
		3Ph fault on Round Mtn 500 kV, Round Mtn 500/230 kV x-former	P1	T-1	none	out of step, tripped		none				
		3Ph fault on Vaca Dix 500 kV, Vaca Dix 500/230 kV x-former	P1	T-1	none	out of step, tripped		vlt dip 64%, freq oscill.				
		3Ph fault Contra-Costa-Brentwood and Contra Costa-Delta 230 kV	P7	L-2	none	vlt dip 27%		vlt dip 38%				
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2	vlt dip 31%	vlt dip 27%		vlt dip 33%				
		3 Ph fault Contra Costa-La Positas and C.Costa-Lone Tree 230 KV	P7	L-2	none	vlt dip 28%		vlt dip 40%				
		3Ph Fault on Gates 230 kV Gates-Arco, Gates-Midway 230 kV	P7	L-2	vlt dip 32%	vlt dip 27%		vlt dip 33%				

Study Area: PG&E Bulk

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
		3ph fault on Los Banos, 500 kV DLO North of Los Banos	P7	L-2	vlt dip 57%, freq oscill.	vlt dip 31%		vlt dip 37%				
		3ph fault on Los Banos, 500 kV DLO South of Los Banos	P7	L-2	vlt dip 30%	vlt dip 41%		vlt dip 46%				
		3ph fault on Table Mtn, 500 kV DLO South of Table Mtn	P7	L-2	none	vlt dip 62%		none				
		3ph fault on Tracy, 500 kV DLO South of Tracy	P7	L-2	none	vlt dip 46% , freq oscill.		vlt dip 63%				
		3ph fault on Tesla, 500 kV DLO North of Tesla	P7	L-2	none	vlt dip 39%		vlt dip 62%				
		3ph fault on Midway 500 kV, Midway-Diablo # 1 and 2 500 kV	P7	L-2	vlt dip 32%	vlt dip 61% , freq oscill.		vlt dip 63%				
		3ph fault on Midway 500 kV, DLO North of Midway 500 kV	P7	L-2	vlt dip 62%, freq oscill.	vlt dip 63%, freq oscill.		vlt dip 63%				
		3ph fault on Gregg, Gregg-Herndon 230 kV # 1 and 2	P7	L-2	none	none		vlt dip 30%				
		3ph fault on Pittsburg 230 kV, Pittsburg-Tesla 230 kV # 1 and 2	P7	L-2	none	none		tripped for out of step				
		3Ph fault on Midway 230 kV, Midway-Kern # 2 and 3 230 kV	P7	L-2	tripped for out-of-step	vlt dip 45%		vlt dip 62%, freq oscill.				
		3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Gates 500 kV, Gates-Midway 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Midway 500 kV, Gates-Midway 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Gates 500 kV, Gates-Diablo 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Los Banos, Los Banos-Gates # 1 or # 3 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway, Los Banos-Midway 500 kV	P1	L-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Los Banos, Los Banos-Midway 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway 500 kV Midway-Vincent # 1, 2 or 3	P1	L-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway 500 kV Midway-Diablo # 1 or 2	P1	L-1	none	tripped for high vlt		none			tripped for high vlt	
		3ph fault on Moss landing, Mosslanding -Los Banos 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Moss landing, Mosslanding -Metcalf 500 kV	P1	L-1	none	none		tripped for high vlt			tripped for high vlt	
		3ph fault on Table Mtn,Table Mtn-Tesla 500 kV	P1	L-1	none	none		none			tripped for high vlt	
		3ph fault on Table Mtn,Table Mtn-Vaca Dix 500 kV	P1	L-1	none	none		none			tripped for high vlt	
		3ph fault on Tesla 500 kV, Tesla -Metcalf 500 kV (same w/DEC off)	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Tesla 500 kV, Tesla -Tracy 500 kV	P1	L-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Tesla 500 kV, Tesla -Los Banos 500 kV	P1	L-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
PGE BIK-TS-4	Solar PV plant Q829 (bus 34347), total 61 MW in Summer peak cases, off in Partial peak, 2017 off-peak and 2020 Min load, 244 MW in 2025 off-peak	3ph fault on Tracy 500 kV, Tracy -Los Banos 500 kV	P1	L-1	none	tripped for high vlt	off in the case	tripped for high vlt	off in the case	off in the case	tripped for high vlt	need to adjust protection settings, currently trips at voltage 1.2 p.u. in 0.001 sec. Contact generator's owners and inquire about protection settings
		3ph fault on Tesla 230 kV, Tesla - Newark 230 kV	P1	L-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Vaca Dix 500 kV,Vaca Dix-Tesla 500 kV	P1	L-1	none	tripped for high vlt		none			tripped for high vlt	
		3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	none	none		none			tripped for low freq w/fault	
		3Ph fault on Newark 230 kV,Newark-Ravenswood 230 kV	P1	L-1	none	none		none			tripped for high vlt	
		3ph fault on Moss landing, Mosslanding 500/230 kV x-former	P1	T-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Los Banos 500 kV, Los Banos 500/230 kV x-former	P1	T-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Metcalf 500 kV, Metcalf 500/230 kV x-former	P1	T-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Tesla 500 kV, Tesla 500/230 kV x-former	P1	T-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Tracy 500 kV, Tracy 500/230 kV x-former	P1	T-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Gates 500 kV, Gates 500/230 kV x-former	P1	T-1	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Table Mtn 500 kV, Table Mtn 500/230 kV x-former	P1	T-1	none	none		none			tripped for high vlt	
		3Ph fault on Vaca Dix 500 kV, Vaca Dix 500/230 kV x-former	P1	T-1	none	none		none			tripped for high vlt	
		3Ph fault on Midway 500 kV, Midway 500/230 kV x-former # 11, 12 or 13	P1	T-1	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Los Banos 500 kV DLO North of Los Banos	P7	L-2	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Tesla 500 kV DLO North of Tesla	P7	L-2	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway 500 kV Midway-Diablo # 1 and 2	P7	L-2	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway 500 kV DLO North of Midway 500kV	P7	L-2	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Midway 500 kV Midway-Vincent # 1 and 2	P7	L-2	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Los Banos 500 kV DLO South of Los Banos	P7	L-2	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3ph fault on Table Mtn 500 kV DLO South of Table Mtn	P7	L-2	none	none		none			tripped for high vlt	
		3ph fault on Tracy 500 kV DLO South of Tracy	P7	L-2	none	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	
		3Ph fault on Gregg 230 kV, Gregg-Herndon # 1 and 2 230 kV	P7	L-2	none	none		none			tripped for high vlt	
		3Ph Fault Gates-Arco, Gates-Midway 230 kV	P7	L-2	tripped for high vlt	tripped for high vlt		tripped for high vlt			tripped for high vlt	

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
PGE Blk-TS-5	Solar PV 33102 Q687, 19 MW 2017 and 2025 off-peak, 4.8 MW in all Peak cases, off in 2020 Minimum load and 2025 Part peak	3ph fault on C.Costa 230kV, C.Cos-Ls Positas 230 kV	P1	L-1	none	none	off in the case	none	none	off in the case	tripped for high voltage	modeled with old solar PV model (wt4g, wt4e), protection trips at 1.1 pu in 1 sec, no issues if shunt capacitor on the collector system is turned off, or generator can absorb reactive power in power flow
		3ph fault Newark 230 kV, Newark-Ravenswood	P1	L-1	none	none		none	none			
		3ph fault Tesla 500 kV, Tesla-Metcalf 500 kV	P1	L-1	none	none		none	none			
		3ph fault Tesla 230 kV, Tesla-Newark 230 kV	P1	L-1	none	none		none	none			
		3ph fault Tesla 500 kV, Tesla-Tracy 500 kV	P1	L-1	none	none		none	none			
		3ph fault Tesla 500 kV, Tesla-Los Banos 500 kV	P1	L-1	none	none		none	none			
		3ph fault Tesla 500 kV, Tesla 500/230 kV x-former	P1	T-1	none	none		none	none			
		3ph fault Tracy 500 kV, Tracy 500/230 kV x-former	P1	T-1	none	none		none	none			
		Vaca Dix 500 kV stuck brk	P4	BRK	none	none		none	none			
		3ph fault Pittsburg 230 kV, Pittsb-Tesla # 1 and 2	P7	L-2	none	none		none	none			
		3Ph fault C. Costa-Ls Positas and C. Costa-Lonetree 230 kV	P7	L-2	none	none		none	none			
		3Ph fault C.-Costa-Brentwood and C. Costa-Delta 230 kV	P7	L-2	none	none		none	none			
PGE Blk-TS-6	Solar PV 34461 GUERNSEY_DIS #1 and # 2, off in 2017 Peak, 2017 off-peak, 2025 Partial Peak, 2020 Min load, total 5 MW in 2020 and 2025 Peak, total 20 MW in 2025 off-peak	Diablo-g1	P1	G-1	off in the case	none	off in the case	none	off in the case	off in the case	tripped for high voltage	modeled as two small solar PV units, no plant control, typical data, unity power factor, tripped when voltage was higher than 1.1 p.u for more than 1 sec. Voltage close to 1.1 in the base case. Need to maintain lower voltages in the base case, can reduce voltage by changing x-former taps
		3ph fault Gates 500 kV, Gates-Diablo 500 kV	P1	L-1		none		none				
		3ph fault Gates 230 kV, Gates-Midway 230 kV	P1	L-1		none		none				
		3ph fault Los Banos 500 kV LosBanos-Gates#1 or # 2	P1	L-1		none		none				
		3ph fault Midway 500 kV, Midway-Vincent# 1, 2 or 3	P1	L-1		none		none				
		3ph fault MossIndg 500 kV, MossInd-Los Banos 500 kV	P1	L-1		none		none				
		3ph fault Gates 500 kV Gates 500/230 kV x-former	P1	T-1		none		none				
		3ph fault Los Banos 500 kV Ls Banos 500/230 kV x-former	P1	T-1		none		none				
		3ph fault Midway 500 kV Midway 500/230 kV x-former # 11, 12 or 13	P1	T-1		none		none				
		3ph fault Midway 500 kV DLO North of Midway	P7	L-2		none		none				
		3ph fault Midway 500 kV Midway-Diablo # 1 and 2 500 kV	P7	L-2		none		none				
		3ph fault Los Banos 500 kV DLO North of Los Banos	P7	L-2		none		none				
		3ph fault Los Banos 500 kV DLO South of Los Banos	P7	L-2		none		none				
		3 ph fault Gregg 230 kV, Gregg - Herndon # 1 and 2	P7	L-2		none		none				
		3ph fault Gates 230 kV Gates-Arco and Gates-Midway 230 kV	P7	L-2		none		none				
		3 ph Gates 230 kV, Gates-Greg and Gates- MCal	P7	L-2		none		none				

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
		3 ph fault Diablo 500 kV, Diablo-Midway # 1 and 2	P7	L-2		none		none				
		Diablo-g2	Extreme	G-2		none		none				
PGE Blk-TS-7	Solar PV 35019 REGULUS, 16,9 MW in all peak cases, off in 2025 partial peak, 2017 off-peak and 2020 min load, 65 MW in 2025 off-peak	3ph fault Midway 500 kV, Midway-Gates 500 kV	P1	L-1	none	none	off in the case	none	off in the case	off in the case	tripped for high freq with fault	Old wt4g, wt4e models, possible modeling error. Over-frequency protection is set to trip the plant in 0.02 seconds at frequency 60.5 Hz. Wasn't tripped with RE models with typical data because freq with fault was lower. Need to discuss protection settings and the plant model parameters with the generation owner.
		3ph fault Midway 500 kV, Midway-Los Banos 500 kV	P1	L-1	none	none		none				
		3ph fault Midway 500 kV, Midway-Vincent 500 kV # 1, 2 or 3	P1	L-1	none	none		none				
		3 ph fault Midway500 kV, Diablo-Midway # 1 or 2	P1	L-1	none	none		none				
		3 ph fault Midway500 kV, Midway500/230 kV x-former	P1	T-1	none	none		none				
		3ph fault Midway 500 kV, Midway-Vincent 500 kV # 1 and 2	P7	L-2	none	none		none				
		3 ph fault Midway500 kV, Diablo-Midway # 1 and 2	P7	L-2	none	none		none				
		3ph fault Midway 500 kV DLO North of Midway	P7	L-2	none	none		none				
PGE Blk-TS-8	Solar PV 34694 KENT_S, 5 MW in all peak cases, off in 2025 partial peak, 2017 off-peak and 2020 min load, 19 MW in 2025 off-peak	3ph fault Gates 230 kV, Gates-Midway 230 kV	P1	L-1	none	none	off in the case	none	off in the case	off in the case	tripped for low voltage with fault	Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Need to discuss protection settings and the plant model parameters with the generation owner.
		3ph fault Gates 230 kV Gates-Arco and Gates-Midway 230 kV	P7	L-2	none	none		none				
		3 ph Gates 230 kV, Gates-Greg and Gates- MCal	P7	L-2	none	none		none				
PGE Blk-TS-9	Load on Gates 115 kV	3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	none	none	none	slow frequency recovery, load tripped with fault, modeling issue because of low impedance between the fault and load. Low load in off-peak cases
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	none	none	none	
		3Ph Fault Gates-Arco, Gates-Midway 230 kV	P7	L-2	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	UFLS reduced load to 6%	none	none	none	
PGE Blk-TS-10	Load on Gates-distr 12.5 kV	3Ph fault on Gates 230 kV, Gates-Midway 230 kV	P1	L-1	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced to 33%	UFLS reduced to 33%	UFLS reduced to 33%	slow frequency recovery, load tripped with fault, modeling issue because of low impedance between the fault and load
		3Ph fault on Gates 230 kV, Gates-Gregg, Gates-Mc Call 230 kV	P7	L-2	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced to 33%	UFLS reduced to 33%	UFLS reduced to 33%	
		3Ph Fault Gates-Arco, Gates-Midway 230 kV	P7	L-2	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced load to 33%	UFLS reduced to 33%	UFLS reduced to 33%	UFLS reduced to 33%	
PGE Blk-TS-11	Solar PV Q622 B (35021), 5 MW all peak cases, 18 MW in 2025 Off-peak	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low voltage with fault	tripped for low voltage with fault	off in the case	tripped for low voltage with fault	off in the case	off in the case	tripped for low voltage with fault	Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Need to discuss protection settings and the plant model parameters with the generation owner.
		3Ph fault Midway230 kV, Midway-Kern # 1 and 2 230 kV	P7	L-2	tripped for low voltage with fault	tripped for low voltage with fault	off in the case	tripped for low voltage with fault	off in the case	off in the case	tripped for low voltage with fault	

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
PGE Bk-TS-12	Solar PV ORION (35082), 5 MW in all peak cases, 19 MW 2025 off-peak	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low voltage with fault	tripped for low voltage with fault	off in the case	tripped for low voltage with fault	off in the case	off in the case	tripped for low voltage with fault	Old wt4g, wt4e models. Under-voltage protection trips in 0.02 sec with vlt 0.5 p.u. Over-frequency trips for 60. 5 Hz in 0.02 sec. Need to discuss protection settings and the plant model parameters with the generation owner.
		3Ph fault on Midway 500 kV, Gates-Midway 500 kV	P1	L-1	none	none		none			tripped for high freq	
		3Ph fault on Midway 500 kV, Los Banos-Midway 500 kV	P1	L-1	none	none		none			tripped for high freq	
		3Ph fault on Midway 500 kV, Diablo-Midway 500 kV	P1	L-1	none	none		none			tripped for high freq	
		3Ph fault on Midway 500 kV, Midway-Vincent # 1, 2 or 3 500 kV	P1	L-1	none	none		none			tripped for high freq	
		3Ph fault on Midway 500 kV, Midway 500/230 kV x-former kV	P1	T-1	none	none		none			tripped for high freq	
		3Ph fault Midway500 kV, DLO North of Midway 500 kV	P7	L-2	none	none		none			tripped for high freq	
		3Ph fault Midway500 kV, Midway-VIncent # 1 and 2 500 kV	P7	L-2	none	none		none			tripped for high freq	
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped for low voltage with fault	tripped for low voltage with fault		tripped for low voltage with fault			tripped for low voltage with fault	
		3Ph fault Midway 500 kV, Midway-Diablo # 1 and 2 500 kV	P7	L-2	none	none		none			tripped for high freq	
PGE Bk-TS-13	Solar PV Q654 (39184), 5 MW in all peak cases, 20 MW in 2025 off-peak	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	none	none	off in the case	none	off in the case	off in the case	tripped for high freq/ w fault	Frequency protection trips the unit at 60.5 Hz or 59.3 Hz in 0.02 sec. Need to check the models with the generation owner. Inverter control model wasn't provided. Same refers to the Pumpjack plant (bus 39176)
					tripped for low freq w/ fault	tripped for low freq w/ fault		none			none	
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2								
PGE Bk-TS-14	Generator Fritolay (35048)	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for out of step	none	none	none	none	none	none	small unit, 6 MW,lost synchronism with fault. Possible numerical issue because of not clean convergence
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped for out of step	none	none	none	none	none	none	
PGE Bk-TS-15	Generator Borden D (34253)	3Ph fault on Gregg 230 kV, Gregg-Herndon # 1 and 2 230 kV	P7	L-2	none	tripped for out of step (1.4 MW)	none	none	none	none	none	small unit close to the fault
PGE Bk-TS-16	Solar PV Q557 (35015), 5 MW in all peak cases, 19.8 MW in the 2025 off-peak case	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped for low frequency	tripped for low frequency	off in the case	none	off in the case	off in the case	none	Old wt4g and wt4e models. Protection trips for freq 59.5 Hz in 0.16 seconds. Need to discuss protection settings and the plant model parameters with the generation owner.
		3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped for low frequency	tripped for low frequency		none			none	
PGE Bk-TS-17	70 kV and 115 kV buses around Midway	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	vlt dips up to 47% if pumps not tripped right away	none	vlt dips up to 29%	none	Vlt dip up to 37%	none	none	

Study Area: **PG&E Bulk**

Transient Stability



ID	Generator/Load	Contingency	Category	Category Description	Transient Stability Performance							Potential Mitigation Solutions
					2017 Summer Peak	2020 Summer Peak	2025 Summer Partial Peak	2025 Summer Peak	2017 Spring Off-Peak	2020 Spring Light Load	2025 Summer Partial Peak	
PGE Bk-TS-18	Buena Vista pumps	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped by undervoltage relays	vlt dip up to 26%	vlt dip up to 31%	none	tripped by undervoltage relays	none	none	This is possible numerical issue because of slow convergence due to large amount of inverter-based generation in the area and composite load models. Large voltage dips observed around 0.1 sec after fault clearing. Also slow frequency recovery after the fault in Midway area
PGE Bk-TS-19	Wheeler Ridge pumps	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped by undervoltage relays	vlt dip up to 34%	vlt dip up to 42%	vlt dip up to 33%, may be tripped by under-voltage relays	tripped by undervoltage relays	none	none	
PGE Bk-TS-20	Wind Gap pumps	3Ph fault on Midway 230 kV, Gates-Midway 230 kV	P1	L-1	tripped by undervoltage relays	vlt dip up to 33%	tripped by undervoltage relays	vlt dip up to 32%, may be tripped by under-voltage relays	tripped by undervoltage relays	none	vlt dip 31.4%	
PGE Bk-TS-18	Buena Vista pumps	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped by undervoltage relays	vlt dip up to 28%	vlt dip up to 34%	none	tripped by undervoltage relays	none	none	
PGE Bk-TS-19	Wheeler Ridge pumps	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped by undervoltage relays	vlt dip up to 38%	vlt dip up to 37%	tripped by under-voltage relays	tripped by undervoltage relays	none	Vlt dip 33.5% on # 2	
PGE Bk-TS-20	Wind Gap pumps	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	tripped by undervoltage relays	vlt dip up to 36%	tripped by undervoltage relays	tripped by under-voltage relays	tripped by undervoltage relays	none	vlt dip 25%-32.3%	
PGE Bk-TS-17	70 kV and 115 kV around Midway	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	vlt dips up to 49% if pumps not tripped right away	vlt dips <30%	vlt dips up to 33%	none	vlt dip up to 38%	none	none	
PGE Bk-TS-21	SMYRNA 115 kV	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	UFLS	UFLS	none	none	none	none	none	
PGE Bk-TS-22	FAMOSO 115 kV	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	UFLS	UFLS	none	none	none	none	none	
PGE Bk-TS-23	CHARKA 115 kV	3Ph fault on Midway 230 kV, Midway - Kern PP# 2 and 3 230 kV	P7	L-2	UFLS	UFLS	none	none	none	none	none	
		Midway 230 kV Substation w/RAS	Extreme	Subst	unstable			unstable				need more studies
		Midway 500 kV Substation w/RAS	Extreme	Subst	unstable			unstable				Need more studies
		NE/SE separation	Extreme		unstable	unstable	unstable	unstable	unstable	unstable	unstable	Need more studies

Study Area: PG&E Bulk

Single Contingency Load Drop



ID	Worst Contingency	Category	Category Description	Amount of Load Drop (MW)								Potential Mitigation Solutions
				Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
X-SLD-1												

No single contingency resulted in total load drop of more than 250 MW.

Study Area: PG&E Bulk



Single Source Substation with more than 100 MW Load

ID	Substation	Load Served (MW)								Potential Mitigation Solutions
		Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
X-SS-1										

No single source substation with more than 100 MW Load